

Application Serial No. 10/603,306  
Reply to Office Action of September 13, 2004

PATENT  
Docket: CU-3271

### Amendments To The Claims

The listing of claims presented below will replace all prior versions, and listings, of claims in the application.

#### Listing of claims:

1. (Currently Amended) A method for forming a capacitor of a semiconductor device comprising the steps of:

forming an interlayer insulating film on a semiconductor substrate formed with a bit line;

forming a contact plug in contact with the substrate within the interlayer insulating film,

forming a storage electrode of polysilicon on the interlayer insulating film in such a manner that the storage electrode comes in contact with the contact plug,

forming layers of  $Ta_2O_5$  and  $Y_2O_3$  one layer over the other layer in an alternating fashion on the storage electrode according to ALD (Atomic Layer Deposition) technology,

forming a dielectric film ~~composed~~ of a single composite film having  $Ta_2O_5$  and  $Y_2O_3$  of  $Ta_2O_5(X)Y_2O_3(1-X)$  on the storage electrode ~~according to ALD (Atomic Layer Deposition) technology,~~

depositing a diffusion barrier film on the dielectric film, and

forming a plate electrode of polysilicon on the diffusion barrier film

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2. (Currently Amended) The method according to claim 1, wherein the step of forming the dielectric film comprises the sub-steps of:

~~repetitively depositing a Ta<sub>2</sub>O<sub>5</sub> thin film and a Y<sub>2</sub>O<sub>3</sub> thin film in alternation to a predetermined thickness with ALD technology,~~  
performing low temperature annealing of the alternately deposited ~~thin~~ films of Ta<sub>2</sub>O<sub>5</sub> and Y<sub>2</sub>O<sub>3</sub> converting the deposited films to convert the thin films into a single composite film,  
performing N<sub>2</sub>O plasma annealing of the converted single composite film to remove carbon and impurities contained within the single composite film, and  
performing furnace annealing of the N<sub>2</sub>O plasma annealed single composite film to crystallize the single composite film.

3. (Original) The method according to claim 2, wherein the Ta<sub>2</sub>O<sub>5</sub> thin film is deposited to a thickness of less than 10 Å by alternately injecting Ta(OC<sub>2</sub>H<sub>5</sub>)<sub>5</sub> source gas and H<sub>2</sub>O reaction gas into a reactor at a temperature of 250 to 350 °C according to ALD technology.

4. (Original) The method according to claim 3, wherein inert gas is injected at a period of time between that of injecting the Ta(OC<sub>2</sub>H<sub>5</sub>)<sub>5</sub> source gas and that of

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injecting the  $H_2O$  reaction gas so as to leave no residue of the source and reaction gases.

5. (Currently Amended) The method according to claim 3, wherein each injection of the  $Ta(OC_2H_5)_5$  source gas, the inert gas and the  $H_2O$  reaction gas is performed for 0.1 to 10 seconds.
6. (Original) The method according to claim 2, wherein the  $Y_2O_3$  thin film is deposited to a thickness of less than 5 Å by alternately injecting yttrium source gas and  $H_2O$  reaction gas into a reactor at a temperature of 250 to 350 °C according to ALD technology.
7. (Currently Amended) The method according to claim 6, wherein inert gas is injected at a period of time between that of injecting the yttrium source gas and that of injecting the  $H_2O$  reaction gas so as to leave no residue of the source and reaction gases.
8. (Currently Amended) The method according to claim 6, wherein each injection of the yttrium source gas, the inert gas and the  $H_2O$  reaction gas is performed for 0.1 to 10 seconds.

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9. (Original) The method according to claim 3, wherein in the deposition of the  $\text{Ta}_2\text{O}_5$  thin film and the  $\text{Y}_2\text{O}_3$  thin film,  $\text{O}_2$  or  $\text{N}_2\text{O}$  gas is injected as the reaction gas in place of  $\text{H}_2\text{O}$ .

10. (Currently Amended) The method according to claim 4, wherein any one selected from the group consisting of  $\text{N}_2$ , Ar ~~or~~ and He is injected as the inert gas.

11. (Currently Amended) The method according to claim 2, wherein the  $\text{Ta}_2\text{O}_5$  ~~thin films~~ and the  $\text{Y}_2\text{O}_3$  ~~thin films~~ are repetitively deposited in an alternating order alternation-up to an overall thickness of 100 to 200 Å.

12. (Currently Amended) The method according to claim 2, wherein the deposition ratio between the  $\text{Ta}_2\text{O}_5$  ~~thin~~ film and the  $\text{Y}_2\text{O}_3$  ~~thin~~ film is about 80% : 20%, respectively X:(1-X).

13. (Currently Amended) The method according to claim 2, wherein the low temperature annealing is performed at a temperature in the range of 400 to 550 °C.

14. (Original) The method according to claim 2, wherein the  $\text{N}_2\text{O}$  plasma annealing is carried out in a rapid thermal annealing mode in which annealing temperature is 300 to 400 °C, annealing time is 60 to 180 seconds and  $\text{N}_2\text{O}$  gas

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flow rate is 10 to 100 sccm.

15. (Original) The method according to claim 2, wherein the furnace annealing is performed at a temperature of 600 to 850 °C for 5 to 60 minutes while N<sub>2</sub>, O<sub>2</sub>, or N<sub>2</sub>O gas flowing in a furnace.

16. (Original) The method according to claim 1, wherein the diffusion barrier film is a TiN film.